



Prevalence of otological disorders in diabetic patients with hearing loss

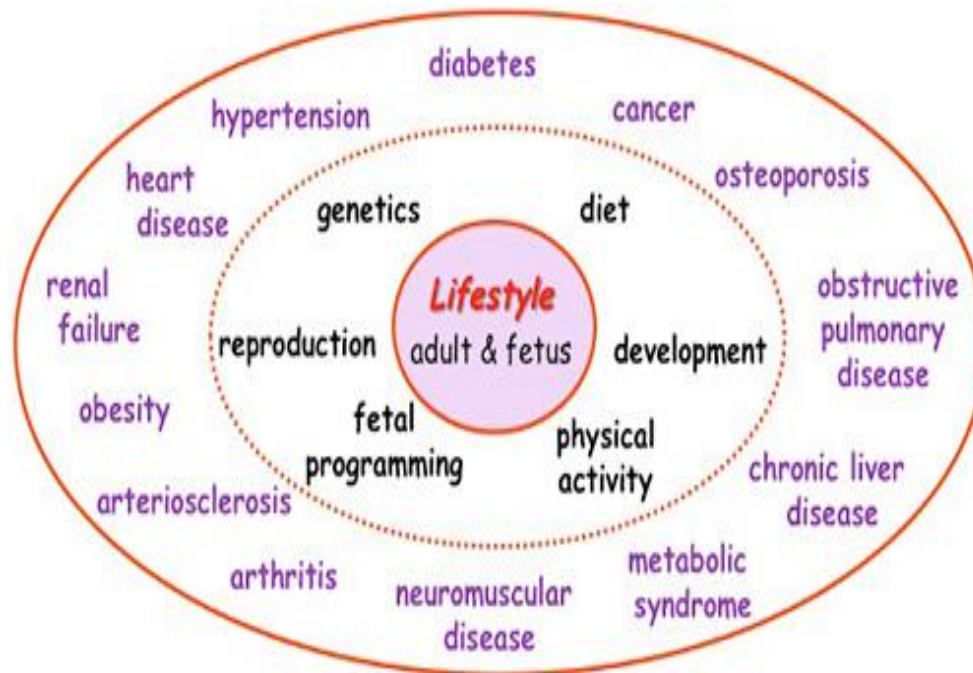
Manche Santoshi Kumari^{†*}, Jangala Madhavi^{†*}, Koralla Raja Meganadh^{*}, Akka Jyothy[†]

[†]Institute of Genetics and Hospital for Genetic Diseases, OU, Telangana State, India

^{*}MAA Research Foundation, Hyderabad, Telangana State, India

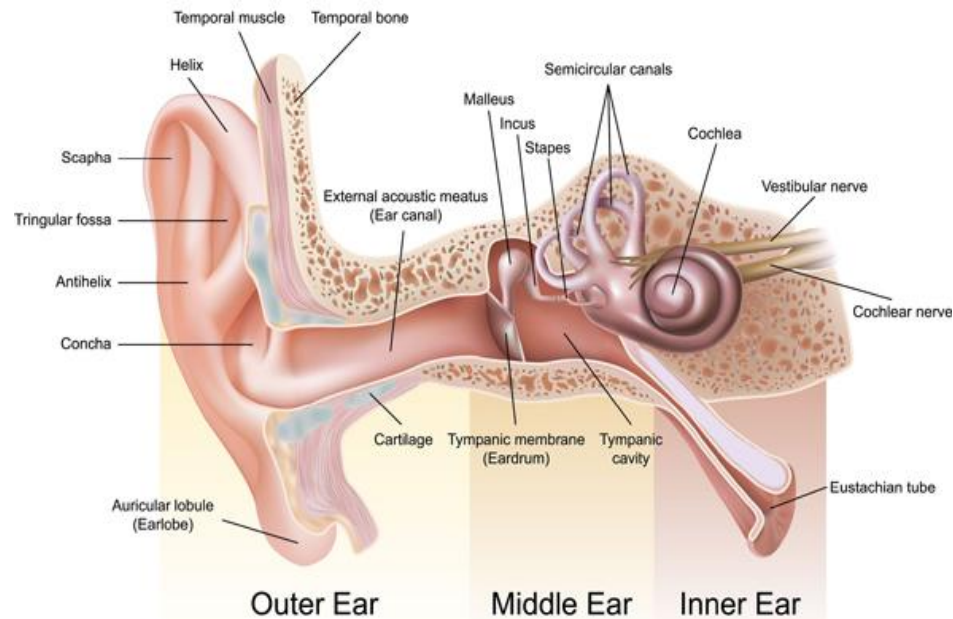
Diabetes mellitus

- Prevalence all over the globe is increasing at an alarming rate.
- India is the “Diabetes capital of the world”.
- Increased propensity for developing a broad spectrum of irreversible complications.



Diabetes with hearing loss

- Alterations in glucose levels affect nearly every organ system in the body.
- Affects the auditory system - leads to the onset of hearing loss.
- Prevalence of hearing loss in diabetic patients is increasing (Mitchell et al., 2009).



Otological disorders

Diseases of Ear



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graph TD; A[Diseases of Ear] --> B[External Ear]; A --> C[Middle Ear]; A --> D[Inner Ear]; B --- B1[Cerumen impaction]; B --- B2[Congenital ear anomalies]; B --- B3[Otitis externa]; B --- B4[Otomycosis]; B --- B5[Referred otalgia]; C --- C1[Acute suppurative otitis media]; C --- C2[Chronic suppurative otitis media]; C --- C3[Otitis media with effusion]; C --- C4[Otosclerosis]; D --- D1[Cervical vertigo]; D --- D2[Congenital hearing loss]; D --- D3[Meniere's disease]; D --- D4[Presbycusis]; D --- D5[Sudden sensorineural hearing loss]; D --- D6[Traumatic lesions]; D --- D7[Ototoxicity];
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External Ear

- Cerumen impaction
- Congenital ear anomalies
- Otitis externa
- Otomycosis
- Referred otalgia

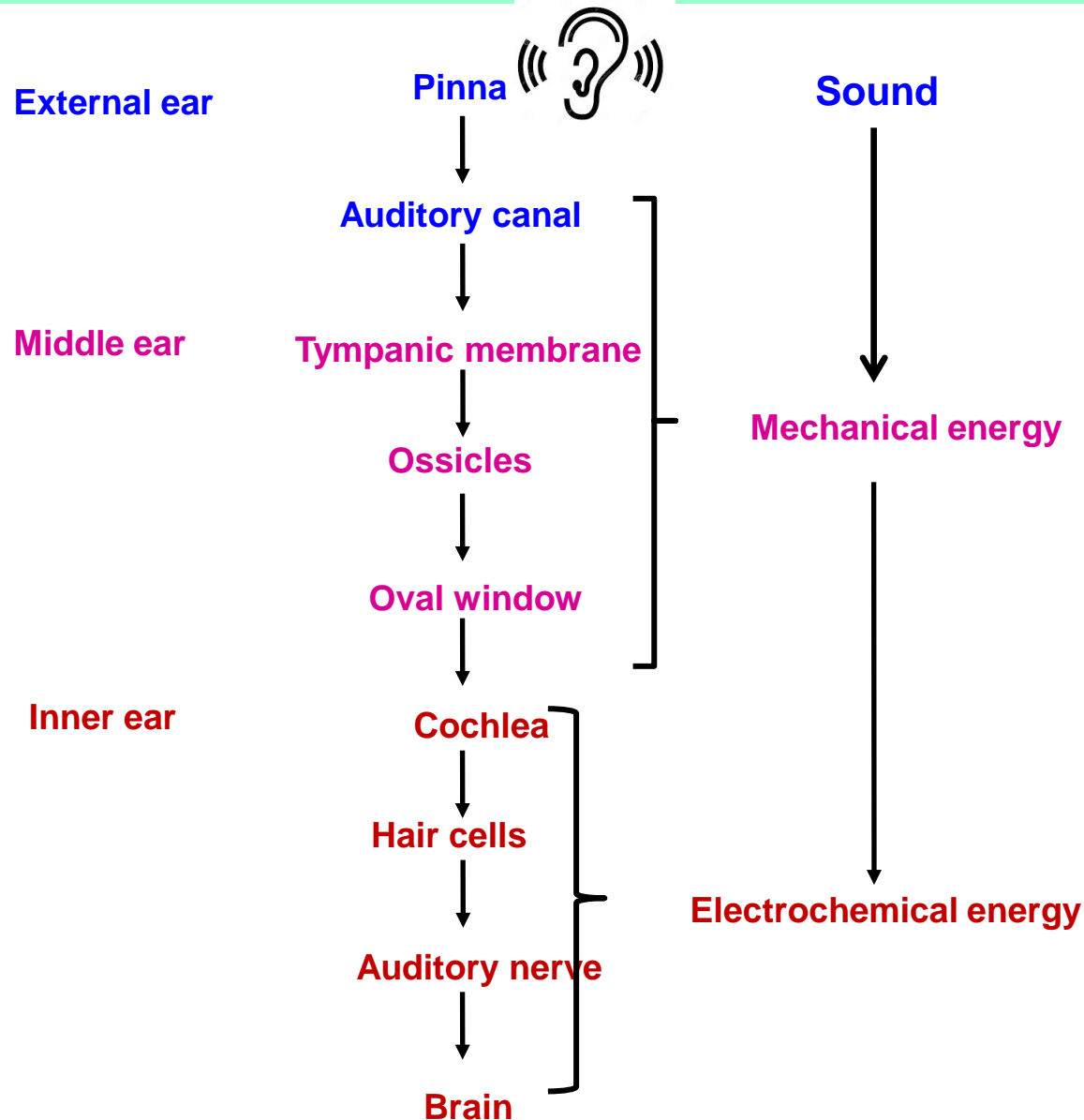
Middle Ear

- Acute suppurative otitis media
- Chronic suppurative otitis media
- Otitis media with effusion
- Otosclerosis

Inner Ear

- Cervical vertigo
- Congenital hearing loss
- Meniere's disease
- Presbycusis
- Sudden sensorineural hearing loss
- Traumatic lesions
- Ototoxicity

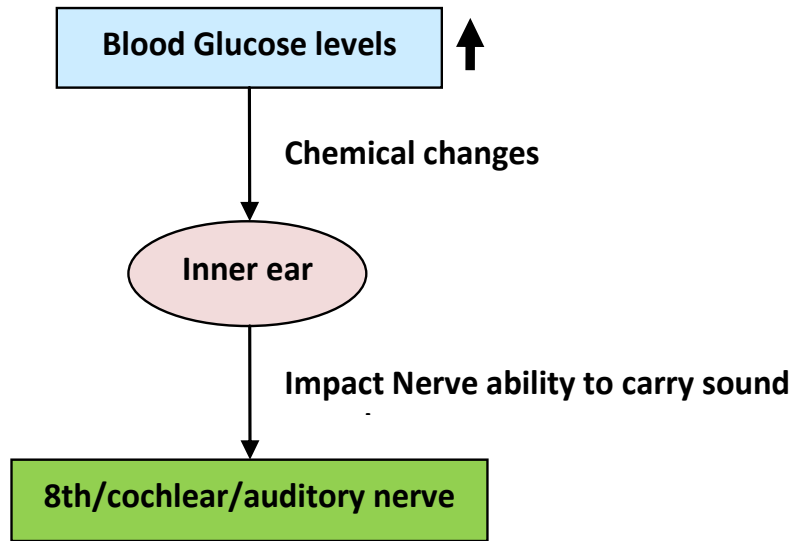
Sound transmission pathway



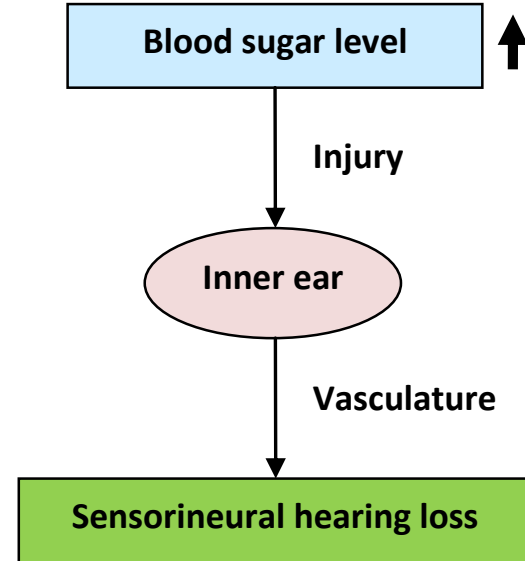
Pathological changes caused by diabetes in the auditory system

1. Structures of the cochlea
2. Auditory nerve
3. Blood supply to cochlea
4. Central auditory processing

Microvascular and neuropathic changes in the cochlea

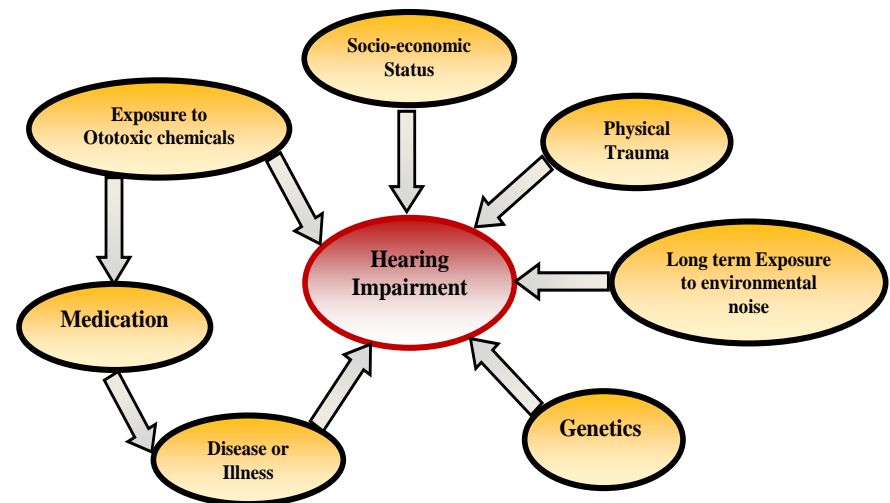


Nerve damage associated with auditory system



Hearing impairment

- Hearing impairment is a common sensory disability to comprehend sound in auditory pathway of one or both ears.
- Patterns of hearing loss:
 - Conductive (outer and/or middle ear)
 - Sensorineural (inner ear)
 - Mixed (outer/ middle/inner ear)
 - Central (brain stem lesions)



Degree of hearing loss

Degree of hearing loss	Hearing loss range(dB HL)
Normal	-10 to 15
Minimal	16 to 25
Mild	26 to 40
Moderate	41 to 55
Moderately severe	56 to 70
Severe	71 to 90
Profound	91+

Source: Clark, J. G. (1981). Uses and abuses of hearing loss classification. Asha, 23, 493–500.

Importance of the study

- **Hearing loss and diabetes (DM2) are significant health issues in the elderly population.**
- **Studies on hearing loss in diabetes have not received attention in South Indian population.**
- **For determining the magnitude and onset of hearing loss in diabetic population of South India.**

Objectives

- To determine the demographic and otological parameters in diabetic subjects affected with hearing loss.
- To investigate the prevalence of otological diseases and hearing loss patterns in adults suffering from diabetes in South Indian population.

Subjects

- 174 diabetic cases affected with hearing loss and 420 non-diabetic constituted the study subjects
- MAA ENT Hospitals, Hyderabad, Telangana State, India
- Age ≥ 40 years were included in the study.
- Confirmatory diagnosis was done by the general physician and ENT specialist.
- Otological examinations were carried out to diagnose the disorders.
- Hearing loss was evaluated using pure tone audiometry and average for the frequencies at 0.5,1,2,4 and 8 kHz was recorded.

Statistical Analysis

The data obtained was coded for statistical evaluations.

Analysis was performed using the Statistical Package for Social Sciences PASW STATISTICS 18.0 software (SPSS Inc., Chicago, IL, USA).

Continuous data is represented as means and standard deviations.

Categorical data as proportions and percentages for illustrations.

Chi-square test and binary logistic regression analysis was used for evaluating the association of various parameters.

Table 1. Distribution of gender, age and otological parameters in diabetic and non diabetic study subjects

Parameters	Diabetic (n=174)	Non-diabetic(n=420)	OR(95% CI)††
Gender			
Female	60(34.5)	182(43.3)	1.00(Reference)
Male	114(65.5)	238 (56.7)	1.45(1.03-2.04)*
Age(years)†	58.3±11.36	55.5±11.47	NC
Age of onset(years)†	56.2±11.31	54.4±10.62	NC
40-60	108(62.1)	307 (73.0)	1.00(Reference)
>60	66(37.9)	113(26.9)	1.65(1.17-2.32)**
Laterality			
Unilateral	62(35.6)	191(45.5)	1.00(Reference)
Bilateral	112(64.4)	229(54.5)	1.51(1.07-2.11)*
Mean PTA(dBHL)	50.5±17.34	49.4±17.54	NC
<40dB	71(40.8)	167(39.7)	1.00(Reference)
>40dB	103(59.2)	253(60.3)	0.95(0.68-1.33)
Associated symptoms			
Tinnitus	56(32.2)	161(36.0)	0.83(0.59-1.17)
Vertigo	24(13.8)	69(15.3)	0.97(0.60-1.56)

a. † -Independent sample t test(mean ± standard deviation);

b. Values in paranthesis are percent frequency; NC-Not calculated.

c. †† - Chi-square test

Table 2. Association of gender and otological parameters with age of onset in diabetic subjects affected with hearing loss

Parameters	Total	40-60 years	>60 years	P-value	OR(95% CI)
Gender†					
Male	114(65.5)	59(51.8)	55(48.2)	0.036	1.00(Reference)
Female	60(34.5)	41(68.3)	19(31.7)		0.49(0.26-0.96)*
Laterality†					
Unilateral	2(35.6)	43(44.3)	19(24.7)	0.007	1.00(Reference)
Bilateral	112(64.4)	54(55.7)	58(75.3)		2.43(1.26-4.67)**
Degree of hearing loss(Decibels-dB)†					
<40 dB	26(14.9)	10(13.0)	16(61.5)	0.519	1.00(Reference)
>40dB	148(85.1)	67(87.0)	81(83.5)		1.32(0.56-3.11)
Types of hearing loss††					
Conductive hearing loss	77(44.3)	24(31.2)	53(54.6)	<0.001	1.00(Reference)
Sensorineural hearing loss	67(38.5)	23(23.7)	44(57.1)		4.23(2.10-8.48)***
Mixed hearing loss	30(17.2)	9(11.7)	21(21.6)		0.95(0.38-2.37)

a. Values in paranthesis are percent frequency

b. †-Chi-square test, ††-binary logistic regression analysis

Figure 1. Prevalence of otological disorders in diabetic and non diabetic study subjects

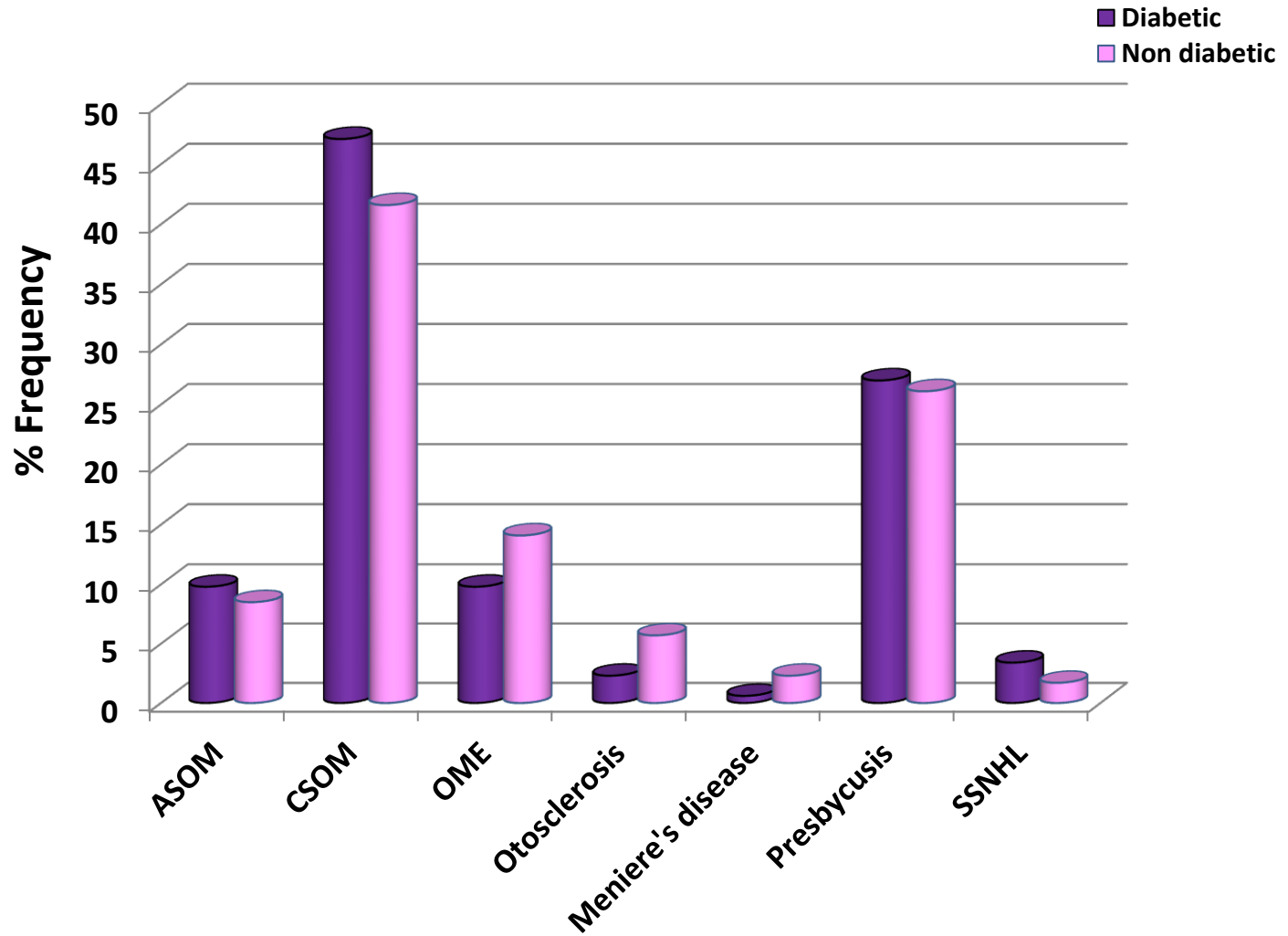


Figure 2. Distribution of otological diseases at different age groups in diabetic and non diabetic study subjects

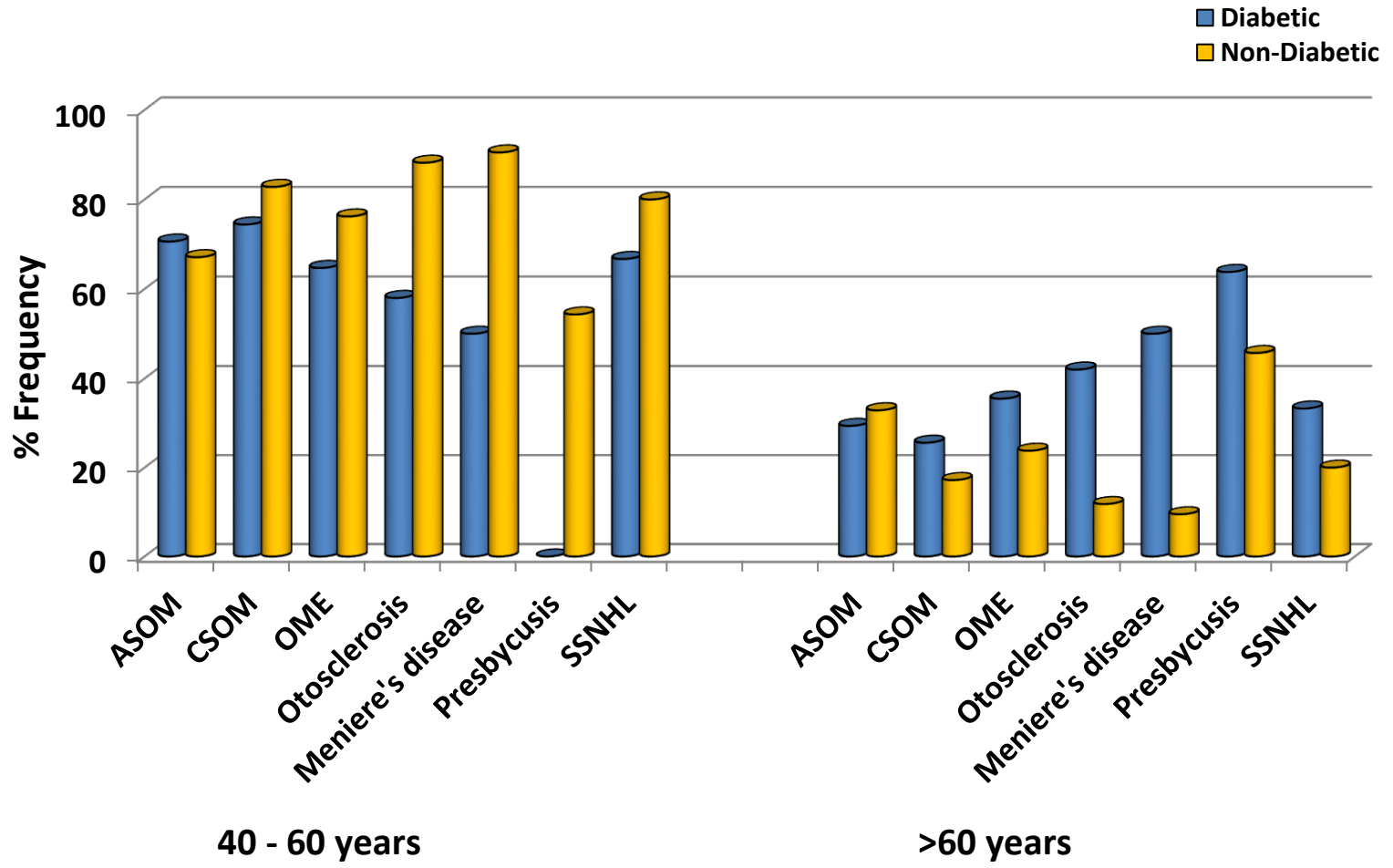


Figure 3. Prevalence of otological diseases in the study subjects with laterality in diabetic and non diabetic study subjects

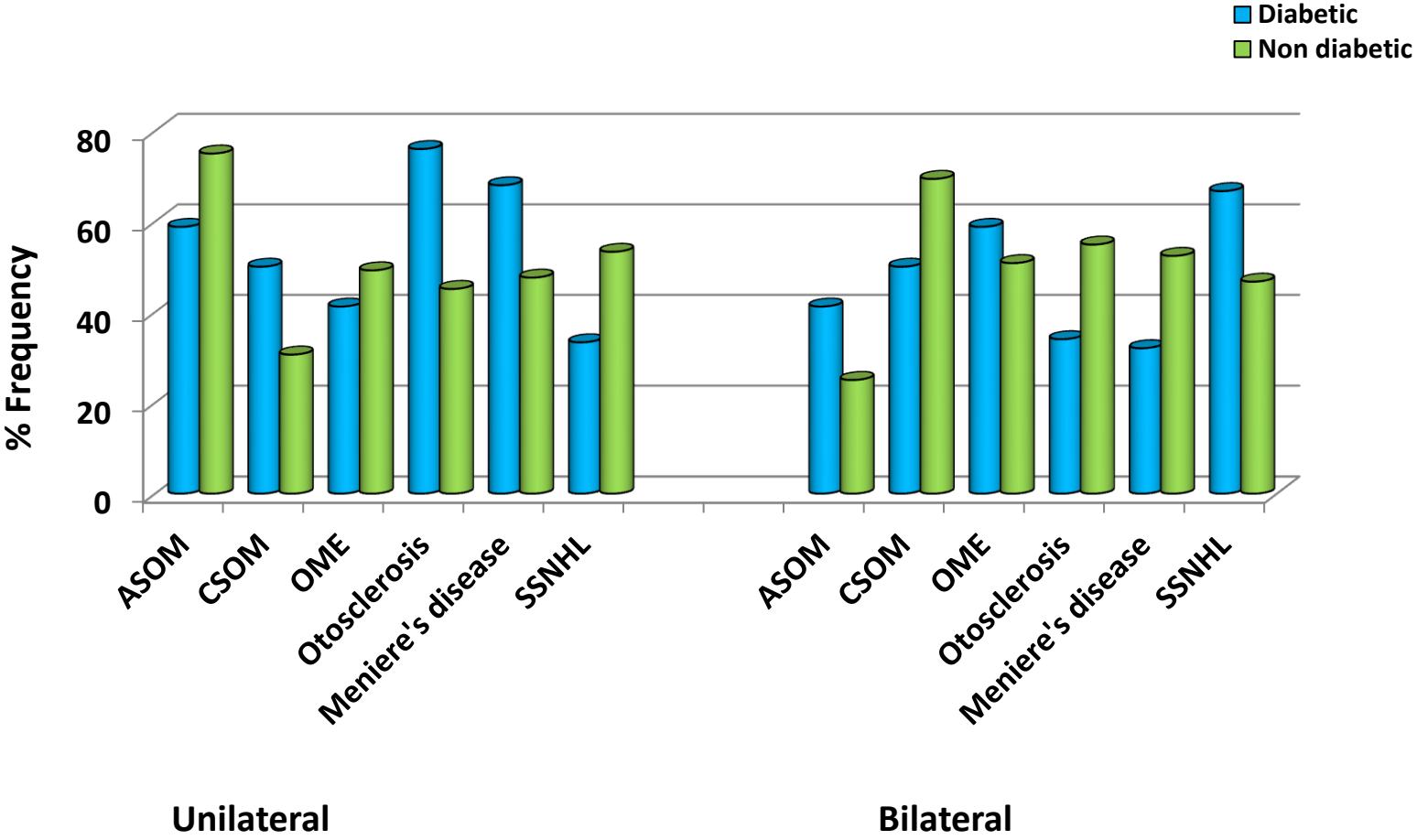


Figure 4. Distribution of hearing loss patterns in otological diseases of diabetic and non diabetic study subjects

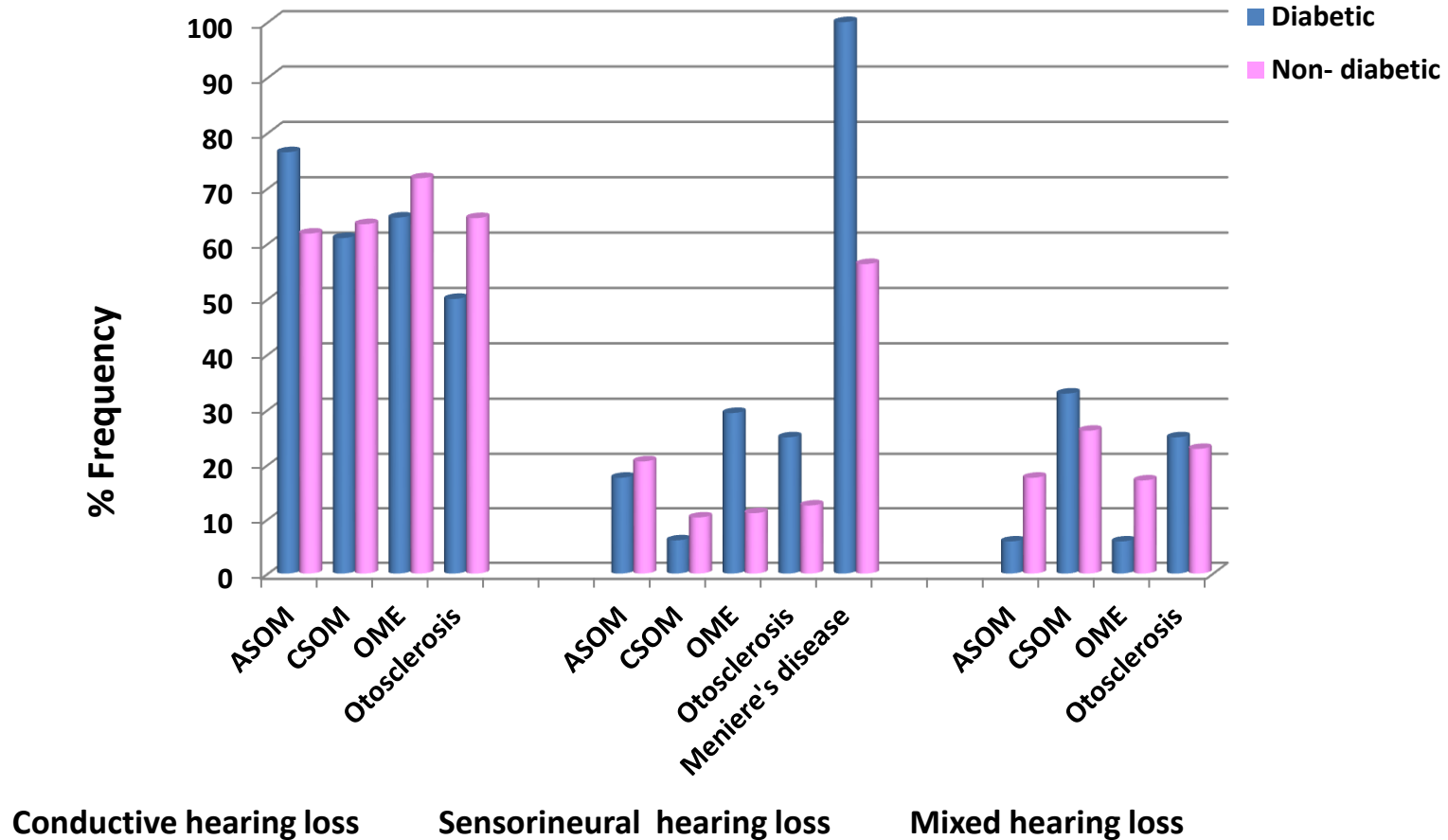
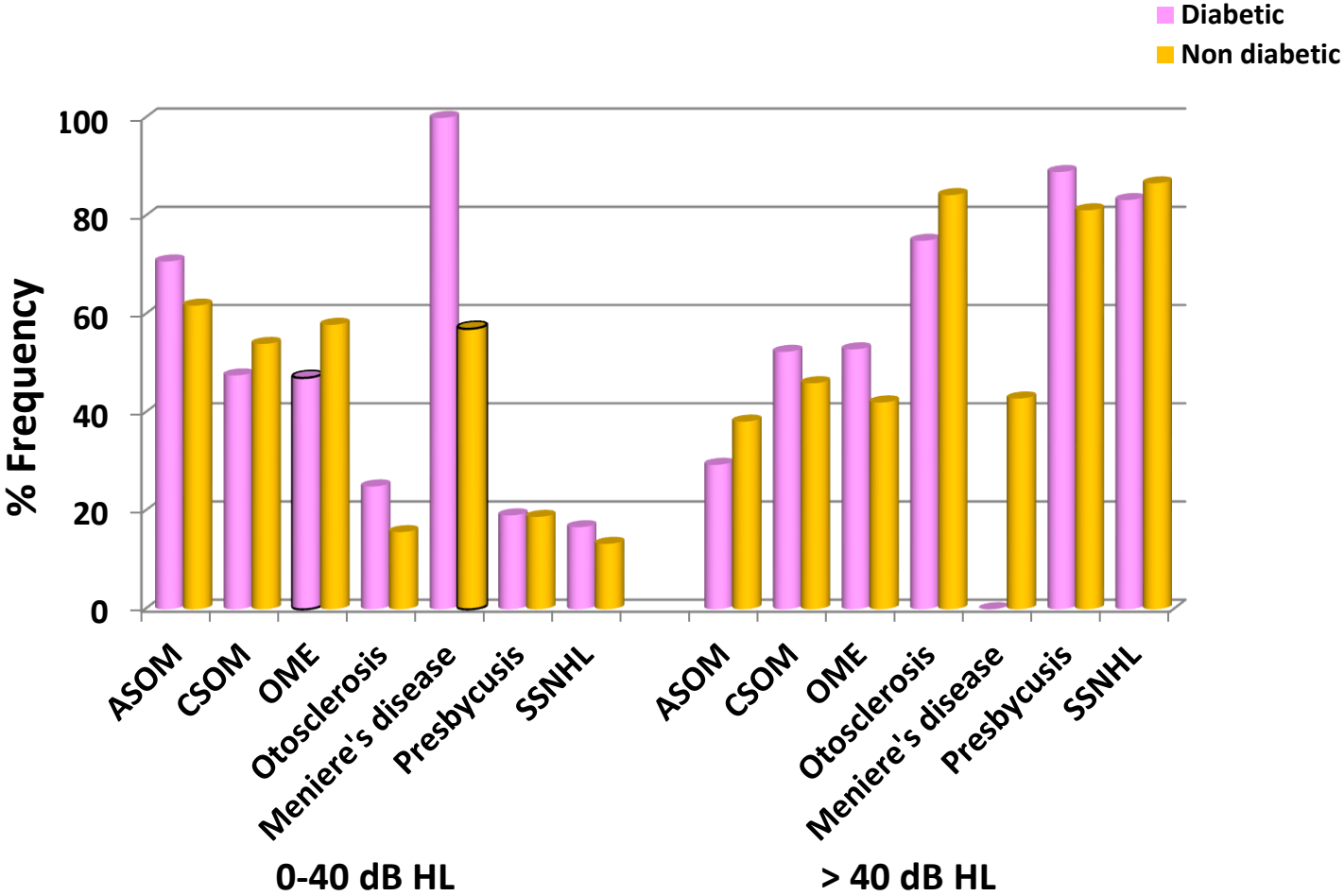


Figure 5. Prevalence of hearing loss at lower(<40dB) and higher frequency (>40dB) in otological diseases of diabetic and non diabetic study subjects



Results

- **Male preponderance(1.9)** was observed.
- **Prevalence of hearing loss was more in subjects >60 years of age (55.7%).**
- **Prevalence of bilateral hearing loss was more in diabetic subjects.**
- **85.1% of study subjects showed hearing loss at higher frequency (>40 dBHL).**
- **Hearing loss was more prevalent in presbycusis (61.3%) and acute suppurative otitis media (27%)among diabetic cases.**
- **32.2% of the diabetic subjects showed tinnitus.**
- **44.3% of the diabetic subjects showed conductive type followed**

by 38.5 % of sensorineural and 17.2% of mixed hearing loss.

Association of hearing loss with age of onset of diabetes

- Bilateral form of hearing loss was observed to be more in subjects >60 years of age group.
- Sensorineural hearing loss was significantly associated with increase in age.

Otological disorders

- Prevalence of presbycusis was predominant at higher age group.
- Bilateral form of hearing loss was noticed in Meniere's disease and presbycusis.
- Otitis media, otosclerosis and sudden sensorineural form of hearing loss showed unilaterality.

- Sensorineural form of hearing loss was noticed to be high in **Meniere's disease, OME and otosclerosis.**
- Conductive hearing loss was noticed more in **ASOM.**
- **Presbycusis, CSOM and OME** were observed to have hearing loss at **>40dBHL.**
- Hearing loss at lower frequency (<40dBHL) was noticed at **ASOM, otosclerosis and Meniere's disease.**

Conclusion

- **Presbycusis and otitis media** were the predominant otological disorders found in diabetes patients with hearing loss.
- **Sensorineural** form of hearing loss was found to significantly associated with the elderly age group (**>60 years**).
- **Conductive form** of hearing loss was more prevalent in subjects suffering from **ASOM**.
- Sensorineural form of hearing loss was high in **Meniere's disease, OME and otosclerosis**.
- Hearing disability (**>40dB**) was more in otological disorders of **otosclerosis, Meniere's disease and presbycusis**
- **ASOM and sudden sensorineural hearing loss** showed prevalence even at lower decibel range(**<40dB**).

Significance of the study

- The study helped to establish the prevalence otological disorders to be more prevalent in diabetic subjects is caused by the **dysfunction of middle and inner ear.**
- Diabetes is associated with hearing disorders in **above 60 years** age group than between **40-60 years.**
- Effective control of diabetes is to be considered to reduce the incidence of deafness in above 60 years.

Acknowledgement

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Thank you